REMARKS

Claims 1 to 4 and 7 to 27 are pending. Claims 1 and 17 are independent.[1] Favorable reconsideration and further examination are respectfully requested.

Regarding the outstanding restriction requirement, the Office Action states the following:

> 3. Applicant's election with traverse of Group I, Claims 1-16 in the reply filed on September 2, 2011 is acknowledged. The traversal is on the ground(s) that the newly amended claims provide the same special technical feature which provides unity and a contribution over the prior art. This is not found persuasive because the newly amended limitations to the apparatus claims are directed towards intended use limitations. It is noted that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, it has been held that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim." Applicant is reminded that claims 17-27 are withdrawn from further consideration by the examiner, as being drawn to a non-elected invention.
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> The requirement is still deemed proper and is therefore made FINAL. [2]

While we disagree that an element "for" doing something is an intended use limitation[3], we have amended claim 17, as shown above, to specify how the recited elements are configured, among other things. Given these amendments, the arguments presented for withdrawal of the restriction

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[1] The Examiner is urged to independently confirm this recitation of the pending claims.
[2] Office Action, pages 2 and 3
[3] If this were the accepted rule, the well accepted "means-plus-function" claim format would be meaningless. However, we note that the claims, as previously written, were not in means-plus-function form.

in the Amendment filed on June 28, 2011 still apply. To summarize those arguments, we submit that there is unity of invention for this application under PCT Rules 13.1 and 13.2. More specifically, PCT Rule 13.2 states

> Where a group of inventions is claimed in one and the same international application, the requirement of unity of invention referred to in Rule 13.1 shall be fulfilled only when there is a technical relationship among those inventions involving one or more of the same or corresponding special technical features. The expression "special technical features" shall mean those technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art.

For the claims amended above, there is a relationship among the inventions of Groups I and II, which involve one or more of the same or corresponding special technical features. As stated in the rule, a special technical feature means "technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art".

In this case, the independent claims of both Groups I and II include the following:

> 1.....
> wherein delivering the sufficient quantity of liquid water comprises:
> determining, for each of a plurality of currents, a maximum voltage for the one or more fuel cells as a function of liquid water flow rate, the each of a plurality of currents being within a range of operating conditions of the one or more fuel cells;
> determining a calibration function expressing a minimum liquid water flow rate as a function of current and/or air stoichiometry, the minimum liquid water flow rate being based on a corresponding maximum voltage; and
> delivering at least the minimum liquid water flow rate for a corresponding current drawn from the one or more fuel cells and/or for the air stoichiometry, the delivered minimum liquid water flow rate being determined by the calibration function.
>
> 17....
> a controller configured to control delivery of the sufficient quantity of liquid water, the controller being configured (i) to determine, for each of a plurality of currents, a maximum voltage for the one or more fuel cells as a function of liquid water flow rate, the each of a plurality of currents being within a range of operating conditions of the one or more fuel cells, (ii) to determine a calibration function expressing a minimum liquid water flow rate as a function of current and/or air stoichiometry, the minimum liquid water flow rate being based on a corresponding maximum voltage, and (iii) to control delivery of at least the minimum liquid water flow rate for a corresponding current drawn from the one or more fuel cells and/or for the air stoichiometry, the delivered minimum liquid water flow rate being determined by the calibration function.

As explained below, it is our belief that the foregoing features define over the art of record and, therefore, qualify as a special technical feature according to PCT rule. Accordingly, we respectfully request withdrawal of the restriction.

Next, the claims were rejected as follows:

> ***Claim Rejections - 35 USC § 112***
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> 4. The claim rejections under 35 U.S.C. 112, second paragraph, on claims 1, 4, 9, 10, 11, and 12 are withdrawn, because claim 1 has been amended and Applicants arguments.
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> 5. The terms "normal range of operating conditions" and "normal operating range" respectively in claims 1 and 4 is a relative term which renders the claim indefinite. The term "normal" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. For the purposes of examination it will be assumed standard operating and testing conditions as taught within the prior art meets the limitations of a range of normal operating conditions.

As shown above, the claims have been amended.

Turning to the art rejections, claims 1 to 3 and 7 to 16 were rejected over WO00/63992 (Brambilla) in view of U.S. Patent Publication No. 2003/0186093 (St-Pierre) and U.S. Patent No. 6,524,733 (Nonobe). We respectfully traverse the foregoing rejection.

Claim 1 recites:

> 1. A method of operating an electrochemical fuel cell stack comprising a plurality of fuel cells, each of the fuel cells comprising an anode, an ion transfer membrane, and a cathode, the method comprising:
>
> delivering fluid fuel to one or more fluid flow channels in each anode of one or more fuel cells in the electrochemical fuel cell stack;

delivering fluid oxidant to one or more fluid flow channels in each cathode of the one or more fuel cells;

exhausting reaction by-products and unused oxidant from the one or more fluid flow channels in each cathode of the one or more fuel cells; and

delivering a sufficient quantity of liquid water to the one or more fluid flow channels in each cathode of the one or more fuel cells such that a relative humidity of 100% is maintained throughout the one or more fluid flow channels in each cathode of the one or more fuel cells;

wherein delivering the sufficient quantity of liquid water comprises:

determining, for each of a plurality of currents, a maximum voltage for the one or more fuel cells as a function of liquid water flow rate, the each of a plurality of currents being within a range of operating conditions of the one or more fuel cells;

determining a calibration function expressing a minimum liquid water flow rate as a function of current and/or air stoichiometry, the minimum liquid water flow rate being based on a corresponding maximum voltage; and

delivering at least the minimum liquid water flow rate for a corresponding current drawn from the one or more fuel cells and/or for the air stoichiometry, the delivered minimum liquid water flow rate being determined by the calibration function.

As explained previously, the applied art is not understood to disclose or to suggest at least the foregoing underlined features of claim 1. In response to our previous arguments, the Office Action states the following:

> In response to Applicant's arguments, please consider the following comments:
>
> (a) the primary reference of Brambilla discloses regulating water flow rate to maximize voltage of the single cells within the fuel cell stack. The teachings of Nonobe are used to further modify Brambilla to include determining the humidification conditions of the fuel cell based on current and voltage so that adjustments can be made to the moisture source to meet the humidification needed based on those measurements making obvious the argued limitations of the claim. Furthermore, in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to these arguments, we note that our arguments do not address the references individually, but rather address the combination of references. More specifically, on page 4, the Office Action states the following:

> Regarding claims 1-3 and 9-12, Brambilla discloses a method of operating a fuel cell stack (30; Figure 1) having an anode, an ion transfer membrane, and a cathode comprising distributing the gaseous reactants (delivering fluid fuel and oxidant to flow channels), manifolds used to discharge reactants (8:4-25; Example 1, 5), and liquid water provided to the fluid flow channels (11: 21-25; Claim 1) to provide a flow rate so as to maximize the voltage of the single cells (12:3-4) but it does not explicitly teach a relative humidity of 100% being maintained throughout the fluid flow channels and towards increasing the quantity of water delivered as a function of fuel cell current and determining a calibration function based on current and/or air stoichiometry. [4]

St-Pierre was cited to make up for this admitted deficiency of Brambilla. In particular, the Office Action states:

> St-Pierre teaches a fuel cell which provides sufficient water to the stack to keep the membrane wet and ionically conductive by maintaining the relative humidity at 100% which defines a boundary between drying and wetting conditions [0050, 0078]. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide a relative humidity of 100% in the fuel cell of Brambilla because St-Pierre recognizes this humidity level keep the membrane wet and ionically conductive. [5]

However, as we understand it, Brambilla and St-Pierre do not disclose, nor does the Office Action allege that they disclose, at least the following underlined features:

[4] Emphasis added
[5] Office Action, page 4

> determining, for each of a plurality of currents, a maximum voltage for the one or more fuel cells as a function of liquid water flow rate, the each of a plurality of currents being within a range of operating conditions of the one or more fuel cells;
> determining a calibration function expressing a minimum liquid water flow rate as a function of current and/or air stoichiometry, the minimum liquid water flow rate being based on a corresponding maximum voltage; and
> delivering at least the minimum liquid water flow rate for a corresponding current drawn from the one or more fuel cells and/or for the air stoichiometry, the delivered minimum liquid water flow rate being determined by the calibration function.

It appears that Nonobe was cited for its alleged disclosure of these features. However, if we can show that Nonobe does not disclose or suggest these features, then the combination of Brambilla, St-Pierre and Nonobe cannot disclose or suggest these features. Consequently, in this case, addressing Nonobe does not constitute addressing the references individually.

As previously noted, Nonobe describes the following:

> a fuel cell system having a polymer electrolyte type fuel cell formed by stacking unit cells, each of which has an electrolyte membrane sandwiched by two electrodes, the system including a fuel gas supplier that supplies a fuel gas to the fuel cell, a fuel gas humidifier that humidifies the fuel gas, a current detector that detects an electric current outputted from the fuel cell, a resistance detector that detects a resistance of the fuel cell, and a humidification condition determiner that determines a condition of humidification of the electrolyte membranes based on the current detected by the current detector and the resistance detected by the resistance detector.[6]

Figs. 4 to 7 of Nonobe show humidification determining routines, which are executable to determine a humidification condition of the fuel cell. The routine shown in Fig. 4, for example, determines whether a differential value of a cell resistance dR/dt at a predetermined current, Iset, is between two resistance differential thresholds α and β (see, e.g., Fig. 4, S208). The location of dR/dt relative to α and β determines whether the humidification of the electrolyte membrane is insufficient (S214), proper (S212), or excessive (S216).[7] The routine shown in Fig. 5 determines whether a differential value of the cell voltage dV/dt at Iset is between an upper threshold γ and a

[6] Col. 2, lines 4 to 16 (emphasis added)
[7] Nonobe, col. 9, lines 30 to 42

lower threshold δ. As above, the location of dV/dt relative to γ and δ determines whether the humidification of the electrolyte membrane is insufficient (S314), proper (S312), or excessive (S316). The routine shown in Fig. 6 detects insufficient or proper humidification of the electrolyte membrane by detecting a change in voltage, ΔV, associated with an increase in oxidative gas supplied to a fuel cell. If ΔV is less than zero, there is insufficient humidification (S414). If ΔV is greater than or equal than zero, there is proper humidification (S414). The routine of Fig. 7 determines whether humidification is proper based on a variation in voltages of individual cells in the fuel cell.[8]

As we understand the Office Action, Brambilla is modified by St-Pierre's method of maintaining a relative humidity of a membrane at 100%. Nonobe was cited for its methods of maintaining humidification, and was cited by the Office Action to incorporate the Nonbe humdification routines into the hypothetical Brambilla/St-Pierre combination. However, even if one were to do that, the resulting hypothetical combination would, at best, maintain humidification according to one of the Nonobe routines described above, and shown in Nonobe's Figs. 4 to 7. None of these routines, however, disclose or suggest the *calibration function* recited in claim 1, in which a minimum liquid water flow rate is expressed as a function of current and/or air stoichiometry, where the minimum liquid water flow rate is based on a corresponding maximum voltage, and a delivered minimum liquid water flow rate is determined by the calibration function. *The mere presence of current and voltage in some of the routines of Nonobe does not render obvious the very specific calibration function claimed.*

[8] See, e.g., Nonobe, col. 11, lines 39 to 63

For at least the foregoing reasons, independent claim 1 is believed to be patentable over the applied art. Independent claim 17 is also believed to be patentable over the applied art for at least the reasons explained above.

Dependent claims are also believed to define patentable features. Each dependent claim partakes of the novelty of its corresponding independent claim and, as such, each has not been discussed specifically herein.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

In view of the foregoing remarks, we respectfully submit that the application is in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

The undersigned attorney can be reached at the address shown below. All telephone calls should be directed to the undersigned at 617-521-7896.

Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: December 14, 2011

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